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ARNOLD ARBORETUM

HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS 02138

A REVISION OF THE BORAGINACEAE OF WEST PAKISTAN AND KASHMIR *

S. M. A. KAZMI

3. *A. euchroma* (Royle) I. M. Johnston, Contr. Gray Herb. 73: 49. 1924; Riedl in Rechinger, Fl. Iranica 48: 164. 1967.

Lithospermum euchromon Royle, Illustr. Bot. Himal. Mount. 1: 305. 1839.

Stenoselenium perenne Schrenk ex Fisch. & C. A. Mey. Enum. Pl. Schrenk 1: 34. 1841.

Arnebia perennis (Schrenk) A. DC. in DC. Prodr. 10: 95. 1846; Ledeb. Fl. Rossica 3: 139. 1847.

Munbya perennis (Schrenk) Boiss. Diagn. Pl. Orient. 11: 115. 1849.

Macrotomia endochroma Hook. f. & Thoms. ex Henderson & Hume in Lahore to Yarkand 328. 1873; Aitchison, Jour. Linn. Soc. 18: 81. 1880; C. B. Clarke in Hook. f. Fl. Brit. India 4: 177. 1883, *in syn.*, *nomen nudum*.

Macrotomia perennis (Schrenk) Boiss. Fl. Orient. 4: 212. 1875.

Macrotomia onosmoides Regel & Smir. Acta Horti Petrop. 2: 624. 1878.

Macrotomia euchroma (Royle) Paulsen, Bot. Tidskr. 27: 216. 1906; Stud. Veg. Pamir 58. 1928; Lipsky, Acta Horti Petrop. 26: 505. 1910.

Macrotomia euchroma var. *subacaulis* Lipsky, Acta Horti Petrop. 26: 510. 1910.

Macrotomia oginoi Kitamura, Act. Phytotax. Geobot. 19: 104. 1963.

Arnebia euchroma subsp. *caespitosa* Rech. f. & Riedl, Oesterr. Bot. Zeitschr. 111: 152. 1962; Riedl in Rechinger, Fl. Iranica 48: 166. 1967, *syn. nov.*

TYPE: India: Naho in Kunawur, *Royle s.n.* (K).

ICON.: Paulsen, l. c. fig. 20. 1928, under *Macrotomia euchroma*.

Perennial, erect, caespitose herb with thick roots rich in purple dye, sometimes to 2 cm. in diameter. Stems many, arising from the axils of the leaves, which formed a sterile basal cluster the preceding year, unbranched, pale to brownish purple, fistulous, \pm striate, to 50 cm. long, covered sparsely or densely with white, thin to thick trichomes, to 2 mm. long with minute to large tuberculate bases. Primary basal leaves lanceolate, entire, acute, attenuate towards the broad, ciliate base, usually imperfectly developed and much smaller than the secondary leaves; secondary basal leaves lanceolate, tapering towards the acute apex, more gradually narrowed into a short, winged, dilated, ciliate base, with one strong prominent rib, to 11 cm. long, 15 mm. broad, sparsely to densely covered on both surfaces with white thick or thin, spreading or subappressed trichomes, to 2 mm. long, with tuberculate bases; lower middle cauline leaves sessile, lanceolate, broadest in the middle of the lower half, then gradually narrowed through the elongate upper half to an acute apex, rounded or subtruncate at the base, to 8 cm. long, 15 mm. broad; upper cauline leaves usually shorter and broader, apex more elongate, rounded to

* Continued from volume 52, p. 363.

sometimes subcordate at the base. Inflorescence terminal, subglobular, tending to become broader than long, not elongated in fruit, 5–6 cm. in diameter, bracteate, bracts short, leaflike, not exceeding the calyces. Pedicels erect, densely hairy, very short in flower, to 5 mm. long in fruit. Calyx divided to the base, lobes hairy, linear-lanceolate, acute, to 10 mm. long, 1.5 mm. broad in flower, enlarged to 20 mm. long, 3 mm. broad in fruit. Corolla purplish-white, purple or brownish-purple, funnelform, 16–22 mm. long, tube 10–15 mm. long, limb 5–7 mm. long and 8–16 mm. in diameter, divided nearly one-half its length, lobes ascending, suborbicular to ovate, throat usually glandless, appendages lacking, but in long-styled flowers occasionally developing 5 small, weakly invaginated swellings, nectary not developed. Anthers borne either at the middle or at the summit of the corolla tube. Style reaching the middle of the tube or slightly exserted, usually forked at the apex; stigmas 2, compressed, rounded, broader than long. Nutlets gray, dusky, irregularly and coarsely tuberculate and more or less rugose, surface dull, covered with microscopic papillae, broad near the middle, 3–4 mm. long, with a well developed keel on the venter, which extends to the beaked apex and continues down the back side, attachment scar flat and frequently bearing 2 ventral traces.

DISTRIBUTION: Iran, Afghanistan, West Pakistan, Kashmir, northwest India to Nepal, Turkestan, Pamir Alaj.

3a. Var. *euchroma*.

Plants less pungently hirsute, having narrower cauline leaves, truncate or roundish at base and less acute at apex in comparison with those of *Arnebia euchroma* var. *grandis*.

West Pakistan: CHITRAL STATE: Haute vallée de Yarkhun, 4000 m., Schmid 2285 (BM, G), upper Yarkhun Valley, Schmid s.n. (MICH); Chitral Gol, left of Chitral, 3300 m., Stainton 2696 (BM); Turikho River, Istar, 3000 m., Stainton 2487 (BM); Birmogh Lasht, 3300 m., Bowes Lyon 735 (BM). GILGIT AGENCY: Baltistan, upper end of Hushe Valley, Chogolisa Glacier, 3500 m., Webster & Nasir 6001 (GH); Chalpani Nala, Duthie 13855 (BM, E); Turmih Nullah, 3000 m., Ludlow 299 (A, BM); Naltar Lakes, 3500 m., R. R. Stewart 26328 (BM); Deosai Pass from Minimarg, 3300 m., R. R. Stewart 22171 (GH); Satpura Nullah above Skardu, 3000 m., R. R. Stewart 20289 (GH); Karakorum Expedition 1939, Hispar Glacier, east of Sekambarisi Glacier, 4000–4500 m., Russell 1494 (BM); 4000 m., Russell 1535 (BM); Gharesa Glacier, slopes of Buri Harar, 4500 m., Russell 1138 (BM); Baifa Glacier, left bank, 4500–4700 m., Russell 1825 (BM); north of Hindukush, Giles s.n. (E). HAZARA DIST.: Kaghan Valley, 4 miles beyond Burawai, Burttt B932 (E). KURRAM AGENCY: Kurram Valley, Aitchison 498, 824 (G). QUETTA DIST.: Zarghum, Lace 3760 (E).

Kashmir: Dras Valley, 3000–3300 m., Duthie 11695 (E); between Dras and Pindras, 3000 m., Dickason 84 (MICH); southwest of Dras, Mitsahoi-Matayan, 3000 m., 88 road-miles east-northeast of Srinagar, Dickason 85 (MICH); Mata-yan-Mitsahoi, Ladak Road, 3100 m., R. R. Stewart 10004 (GH); Dras, Ladak Road, 300 m., R. R. Stewart 10055 (GH); Zanskar, Chumik Marbo, 4300 m., Koelz 5381 (GH, MICH, US); Tsanskar, Pader on the northern foot of the Shin-

kula Pass to Sülle, *Schlagintweit* 6258 (GH); Kargia, 3300 m., *Koelz* 5460 (GH, MICH, US), 5553 (MICH, US); Bok, Pasni La, 5000 m., *Koelz* 5834 (GH, MICH, US); Zoji La, 3000 m., *Ludlow & Sherriff* 8311 (GH). Miscellaneous: Tibet occ., 14,000–16,000 ped., Herb. Ind. Orient. Hook. f. & Thoms., *Thomson* s.n. (GH-isotype of *Macrotomia endochroma*).

3b. Var. *grandis* (Bornm.) Kazmi, comb. nov.

Macrotomia grandis Bornmüller, Oesterr. Bot. Zeitschr. 47: 289. 1897.

Arnebia euchroma (Royle) I. M. Johnston subsp. *grandis* Riedl, Oesterr. Bot. Zeitschr. 111: 152. 1964; in Rechinger, Fl. Iranica 48: 166. 1967.

TYPE: PERSIA: Kerman, Kuh-e-Laheh Zar, 3600 m., *Bornmüller* 3948 (w-holotype, GH-isotype).

Plants more pungently hirsute, having broader cauline leaves, obviously subcordate at base, abruptly narrowed in the upper half into a long acuminate tip.

DISTRIBUTION OF VARIETY: Iran.

Arnebia euchroma is very variable in the size and indumentum of the leaves, in the density and length of trichomes and the size of their basal tubercles, as well as the length of corolla and calyx.

The primary basal leaves are small and usually imperfectly developed whereas the secondary basal leaves are well developed and reach 11 cm. in length and to 1.5 cm. in width. Usually the primary leaves disappear on the emergence of the secondary leaves. The cauline leaves are more stable in their shape compared to the basal ones. The latter have broad sessile bases, broadest at the middle of the lower half, then becoming gradually narrowed to acute apices. Only in few specimens from Tibet and Lahul (in northwestern India) were the bases of the cauline leaves found to be slightly subcordate. The trichomes on both surfaces of the leaves vary greatly in their density, the length and the size of their basal tubercles, and whether they are erect or subappressed. I could not establish any correlation between the ratio of corolla and calyx length and the variations in the leaf-size and the type of trichomes borne. Only in a few specimens from Chitral are the cauline leaves narrower compared to those of the specimens from other parts of West Pakistan, Afghanistan and Kashmir. But such plants are also not rare in the collections from Nepal, the easternmost limit of distribution of *A. euchroma*.

The only variation worth recognition is var. *grandis*, based on Bornmüller's collection from Iran, which can be distinguished from the typical variety by being pungently hirsute and having cauline leaves much broader at base, evidently subcordate and abruptly narrowed into a long-acuminate apex.

4. *A. inconspicua* Hemsl. & Lace, Jour. Linn. Soc. Bot. 28: 326. 1891; Riedl in Køie & Rechinger, Biol. Skr. 13(4): 240. 1963, in Rechinger, Fl. Iranica 48: 166. 1967.

Arnebia argyrea Rech. f. Ann. Naturh. Mus. Wien 58: 59. 1951.

Lithospermum inconspicuum (Hemsl. & Lace) I. M. Johnston, Jour. Arnold Arb. 34: 12. 1953.

Macrotomia inconspicua (Hemsl. & Lace) Kitamura, Fl. Afghanistan 321. 1960.

TYPE: BALUCHISTAN: Zarghum, at 9500 ft., 1. 5. 1888, *Lace* 3759 (E-holotype).

ICON.: Riedl, l. c. fig. 187-189. 1963.

Erect perennial herb with a woody rootstock formed of crowded branches, ensheathed by old leaf-bases, from a deep dye-stained root with easily peelable bark. Stem usually solitary, arising from the center of the leaf-rosette, unbranched, 5-15(-25) cm. tall, covered densely with appressed, silvery trichomes, not tuberculate at bases, to 0.5 mm. long, intermixed profusely with spreading, thick, stiff, pungent, white trichomes, to 2 mm. long. Basal leaves linear to linear-lanceolate, entire, sometimes slightly revolute at margins, acute with a prominent midrib below, covered with trichomes like those of the stem, 3-7 cm. long, 3-5 mm. broad; cauline leaves few, sessile, shorter and narrower. Inflorescence capitate, globular, 3-5 cm. in diameter, slightly elongated in fruit; bracteate, bracts linear; rarely a small cluster of cymes is developed in leaf-axils below the major cluster. Calyx divided nearly to the base, lobes subulate-linear, more or less equalling the corolla tube, 10-16 mm. long, \pm 1 mm. broad at base, not elongated in fruit. Flowers heterostyled. Corolla whitish to yellow, sometimes purplish-yellow in dried specimens, narrowly tubular, externally hairy, trichomes appressed, glabrous within with few scattered trichomes on the lobes, 12-19 mm. long; tube 9-12 mm. long, throat funnelform, somewhat glanduliferous, short, 2 mm. long in short-styled flowers; tube 12-14 mm. long and 2 mm. thick at base, 1-1.5 mm. above the base, and above very gradually broadening into the throat in long-styled flowers; limb ascending, 2.5-4.5 mm. in diameter, lobes triangular-ovate, acute, 1-2 mm. long. Anthers 2 mm. long; filaments very short, inserted either above the middle of the corolla tube or on the throat. Style forked, branches slightly unequal, reaching the middle or up to the throat of the corolla tube, stigmas 2, distinct, compressed, nearly as long as broad. Usually one nutlet developed, ovate, indistinctly beaked, dorsally and ventrally keeled, smooth, shining, \pm 5 mm. long.

DISTRIBUTION: Afghanistan, West Pakistan.

West Pakistan: QUETTA DIST.: Zarghun, 2800 m., *Lace* 3759 (E); Zahru, *Stocks* 866 (K-in part); Quetta to Ziarat, at the top of Pass, 2500 m., *Lamond* 1176 (E); *Kazmi* 1663b (PES); in montibus S.W. Ziarat, 2200-2500 m., *Rechner* 29346 (G, w). Miscellaneous: Without locality, 1891-1894, *Elliot s.n.* (K).

5. *A. hispidissima* (Lehm.) A. DC. in DC. Prodr. 10: 94. 1846; Jaub. & Spach, Illustr. Fl. Orient. 4: 100. 1852; Boiss. Fl. Orient. 4: 213. 1875; C. B. Clarke, Jour. Linn. Soc. Bot. 18: 524. 1881; in Hook. f.

Fl. Brit. India 4: 176. 1883; Riedl in Rechinger, Fl. Iranica 48: 155. 1967.

Anchusa hispidissima Sieber ex Lehm. Icon. 1: 23. 1821, *in synonym*.

Anchusa asperrima Delile, Fl. Aegypt. Illustr. 7. 1813, *nomen nudum*.

Anchusa polygama Hamilton ex G. Don, Gen. Syst. 4: 325. 1837, *in synonym*.

Arnebia asperrima (Del.) Hutch. & Dalz. Fl. W.-Afr. 2: 201, 608. fig. 246. 1931.

Arnebia lutea (A. Rich.) Armori in Pirotta, Ann. Ist. Bot. Roma 8: 161. 1904.

Arnebiola migiurtina Chiov. Fl. Somala, 227. t. 24, fig. 1. 1929.

Arnebia purpurascens (A. Rich.) Baker, Fl. Trop. Afr. 4: 56. 1906.

Dioclea hispidissima (Sieber) Spreng. Syst. Veg. 1: 556. 1825.

Echiochilon hispidissima Tausch, Flora 12: 643. 1820.

Echiodes asperrima (Del.) Rothm. Repert. Sp. Nov. 49: 56. 1940.

Lithospermum hispidissimum Lehm. Icon. 1: 23. t. 39. 1821.

Lithospermum vestitum Wall. Cat. No. 941. 1829, *nomen nudum*; Benth. in Royle, Illustr. Himal. Mount. 305, 1836; G. Don, Gen. Syst. 4: 325. 1837.

Strobila hispidissima G. Don, *Ibid.* 327. 1837.

Toxostigma luteum A. Rich. Tent. Fl. Abyss. 2: 86. 1850. [1851 f. Pritzel.]

Toxostigma purpurascens A. Rich. *Ibid.* 87. t. 77. 1850. [1851 f. Pritzel.]

TYPE: AEGYPTUS: Wadi Gamuhs, Sieber s.n. (BM, GH, W).

ICON.: Wight, Icon. Pl. Indiae Orient. 4: t. 1393. 1848; Jaub. & Spach, l. c. 4: t. 363. 1852; Hutch. & Dalz. l. c. fig. 246. 1931, under *Arnebia asperrima*.

Erect or decumbent annual herb, with dye-stained tap root. Stems solitary to few, compactly branched; the whole plant covered with stout, white, pungent, spreading to rarely subappressed unequal trichomes with large tuberculate bases, the area between the tubercles usually densely covered with soft, nonpungent, usually antrorsely appressed or sometimes spreading white, nontuberculate trichomes, not exceeding 0.5 mm. in length, sometimes these areas puberulous or rarely quite glabrous. Basal leaves few to many, usually drying at anthesis, lanceolate, entire to crenulate or sometimes slightly revolute at margins, acute to subacute, attenuate towards the base, to 5 cm. long, 5 mm. broad; cauline leaves reduced in size upwards. Inflorescence of scorpioid cymes terminating the stem and numerous branches, simple and short in flower, later elongating to 20 cm., bearing closely set flowers or distant fruits, bracteate, bracts narrow to broadly lanceolate. Calyx sessile, divided to the base, lobes linear-lanceolate to lanceolate, acute, unequal, to 7 mm. long and 1.5 mm. broad in flower, not at all to slightly enlarged in fruit. Corolla yellow, densely villulose externally, villulose in a band near the base within, ca. 1 mm. broad, 10–15 mm. long, tube 7–13 mm. long, nectary very narrow, lobulate, sparingly villulose, throat glabrous, without glands or appendages, limb funnelform, 4–8 mm. in diameter, lobes roundish, spreading to suberect, 1–2 mm. long. Flowers heterostyled. Stamens attached at the middle of the upper quarter of the tube or at its summit, anthers 1.2–1.8 mm. long, filaments usually 0.9–1.2 mm. long. Style reaching the middle of the corolla tube or its summit or sometimes even exserted, forked, more

deeply so on the long styles; stigma reniform or in long-styled flowers flabellate-reniform and almost lobed. Nutlets pyramidal-ovoid, broadest at the base, pink to brown, nearly smooth to tuberculate, 1.5–2 mm. long.

DISTRIBUTION: north and east Africa, Arabia, Iran, West Pakistan and plains of northwest India.

West Pakistan: ATTOCK DIST.: Campbellpore, ca. 400 m., *Kazmi 228b* (PES). BANNU DIST.: between Sarai Naurang and Lakki Marwat, 3 miles from Sarai Maurang, *Kazmi 119a* (PES); Bannu to Miram Shah, near Mir Ali, *Kazmi 127a* (PES). CHITRAL STATE: Drosh, 1350 m., *Stainton 2254* (BM). DERA GAZI KHAN DIST.: 25 miles from Dera Ghazi Khan to Taunsa, ca. 300 m., *Kazmi 2566* (PES); 3 miles from Dera Ghazi Khan to Muzzafargarh, ca. 300 m., *Kazmi 2551* (PES). DERA ISMAIL KHAN DIST.: between Moghal Kot and Daraban, *Kazmi 1978b* (PES); Dera Ismail Khan, along the bank of Indus, *Kazmi 2479* (PES); 10 miles to Tank on Dera Ismail Khan-Tank road, *Kazmi s.n.* (PES); N. Dera Ismail Khan, *Rechinger 30024* (G, W). HAZARA DIST.: between Haripur and Hasan Abdal, *Kazmi 134b* (PES); Mansehra, *Kazmi 2491* (PES); HYDERABAD DIST.: 10 miles from Hyderabad towards Hala, *Kazmi 5459b* (PES); between Hyderabad and Tandu Mohammad Khan, *Kazmi 2542* (PES). JHELM DIST.: Jhelum, *Iftakhar Ahmad 54* (MICH); 2 miles from Chakwal to Bhaun, *Kazmi s.n.* (PES); Chanuwala, north of Khewra, *Kazmi s.n.* (PES). KARACHI DIST.: Mauripur, *Kazmi 2532a* (PES); Drig Road, *Kazmi s.n.* (PES), *Jafri*, Dec. 1951, *s.n.* (E); Drig Road near Karachi, *Stearn 27* (K), *Jafri*, Sept. 1951, *s.n.* (E); Malir, *Jafri 2544* (E), *Tasnif 478* (PES); Jemindar ka Landa near Karachi, *Stocks s.n.* (K); Dabbeji, *Koelz 7596* (GH, MICH, US); inter Damloti et Khadeji, *Rechinger 28505* (G, W); *Lamond 745* (E); Manora, *Kazmi 2533a* (PES); between Sonmiani and Uthal, *Kazmi 882a* (PES). LAHORE DIST.: Lahore to Jaranwala, near Sharqpur, *Kazmi s.n.* (PES); Lahore to Raiwind via main highway, 10 miles to Raiwind, *Kazmi s.n.* (PES); Shahadra, near bridge, *Kazmi s.n.* (PES); Lahore, *R. R. Stewart 7091* (GH, K); May 1937, *H. Choudhri s.n.* (GH). MULTAN DIST.: Multan, *Kazmi s.n.* (PES). PESHAWAR DIST.: near Akora Khattak, between Noshehra and Khairpur, *Kazmi 486b* (PES). RAWALPINDI DIST.: Golra, *Kazmi 2522a* (PES); Texila, *Kazmi 2548* (PES). Miscellaneous: bank of Chenab, 1000 ped., *Herb. Ind. Or. Hook. f. & Thoms., 1846, Thomson s.n.* (GH, K); Punjab, *Drummond, Kew Herb. No. 20708* (K); Scinde, *Stocks 417* (K); *Herb. Late East India Co., Falconer s.n.* (GH). Reported from: Kalat, Harboi, S.-E. Kalat, *Hotson 62*, Baluchistan, without locality, *Stocks s.n.*

Arnebia hispidissima is closely related to *Arnebia griffithii*, from which it is distinguished by being more bristly in habit and in having lanceolate, acute to subacute, shorter and narrower basal leaves. The calyx lobes in *A. griffithii* are equal in length, to 9 mm. long and 0.5 mm. broad, whereas in *A. hispidissima* these lobes are usually unequal in length, 7 mm. long, and to 1.5 mm. broad. The corollas in both the species are yellow, but those of *A. griffithii* have prominent dark purple spots at the sinuses of the corolla lobes. In *A. hispidissima* the corolla limbs are slightly zygomorphic, while in *A. griffithii* they are always regular. *A. hispidissima* has a glabrous corolla throat and the tube is minutely hairy in a band nearly 1 mm. broad within, which is not the case in any allied species.

Arnebia hispidissima has a wide distribution from Egypt to the eastern